Claims

1	1. A lithography system comprising:
2	a plurality of lens elements;
3	a lens enclosure establishing a controlled environment between the lens elements
4	in the plurality of lens elements, the plurality of lens elements having a first lens element
5	adapted to face a source of radiation, and having a final lens element comprising a
6	material with an index of refraction greater than 1, and having a surface adapted placed in
7	contact or in close proximity with the sample; and
8	a stage to support said sample in contact or in close proximity with the surface of
9	the final lens element.

- 1 2. The lithography system of claim 1, wherein the material of said final lens element
- 2 comprises one of silicon dioxide, calcium fluoride, aluminum oxide, yttrium fluoride,
- 3 lanthanum fluoride, strontium fluoride.
- 1 3. The lithography system of claim 1, wherein said plurality of lens elements projects
- 2 radiation having a wavelength of about 193nm to the sample.
- 4. The lithography system of claim 1, wherein said plurality of lens elements projects
- 2 radiation having a wavelength of about 157nm to the sample.
- 5. The lithography system of claim 1, including a mask between the source of radiation
- 2 and said plurality of lens elements, and said plurality of lens elements demagnifies an
- 3 object on the mask by a factor greater than 4 at an image plane on or near said sample.
- 1 6. The lithography system of claim 1, including a mask between the source of radiation
- 2 and said plurality of lens elements, and said plurality of lens elements projects an image
- 3 of an object on the mask at an image plane on or near the surface of the final lens adapted
- 4 placed in contact or in close proximity with the sample.

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- 7. The lithography system of claim 1, wherein said sample has a layer adapted to be
- 2 developed in response to radiation projected by the plurality of lens elements, said layer
- 3 having an index of refraction, and wherein said final lens element comprises a material
- 4 having an index of refraction matching the index of refraction of said layer.
- 1 8. The lithography system of claim 1, wherein the final lens element comprises a
- 2 removable slab of said material.
- 1 9. A lithography system comprising:
- 2 a projection lens for imaging an object on a mask onto a sample, one side of the
- 3 projection lens adapted to be placed in contact or in close proximity with the sample and
- 4 an other side of the projection lens adapted to be placed in contact or in close proximity
- 5 with the mask; and
- a stage to support said sample in contact or in close proximity with the projection
- 7 lens.
- 1 10. The lithography system of claim 9, wherein a material of a lens element of said
- 2 projection lens adapted to be placed in contact or in close proximity with the mask,
- 3 comprises a material including one of silicon dioxide, calcium fluoride, aluminum oxide,
- 4 yttrium fluoride, lanthanum fluoride, strontium fluoride.
- 1 11. The lithography system of claim 9, wherein said projection lens projects radiation
- 2 having a wavelength of about 193nm from the mask to the sample.
- 1 12. The lithography system of claim 9, wherein said projection lens projects radiation
- 2 having a wavelength of about 157nm from the mask to the sample.
- 1 13. The lithography system of claim 9, wherein said projection lens demagnifies an
- 2 image on the mask by a factor greater than 4 at an image plane on or near said sample.
- 1 14. The lithography system of claim 9, wherein said projection lens, includes a lens

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- 2 having a surface adapted to be placed in contact or in close proximity with the sample,
- and projects an image of a mask at an image plane on or near said surface of said lens.
- 1 15. The lithography system of claim 9, wherein the lens having a surface adapted to be
- 2 placed in contact or in close proximity with the sample comprises a removable slab of
- 3 said material.
- 1 16. A method for manufacturing integrated circuits, comprising:
- 2 providing a sample having a layer adapted to be developed in response to
- 3 radiation;
- 4 providing a layout object to be projected on said layer;
- 5 placing said layer on said sample in contact or close proximity with a lens element
- of a projection lens, wherein said lens element comprises a material having an index of
- 7 refraction for said radiation greater than 1; and
- 8 imaging the object on said layer through said projection lens.
- 1 17. The method of claim 16, including imaging the object at an image plane so that
- 2 evanescent waves emanating from the lens element transfer the image to said layer.
- 1 18. The method of claim 16, including imaging the object at an image plane near a top
- 2 surface of said layer.
- 1 19. The method of claim 16, including preventing adhesion of said lens element to said
- 2 layer.
- 1 20. The method of claim 16, including placing a mask including said layout object in
- 2 contact or close proximity with another lens element of a projection lens, wherein said
- 3 other lens element comprises a material having an index of refraction for said radiation
- 4 greater than 1.
- 1 21. The method of claim 16, including laying out a layout pattern on a mask including

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- 2 the layout object to be imaged on said layer, said laying out including applying proximity
- 3 correction using a lithography model comprising, for an incident material different than
- 4 air characterized by its refractive index and absorption coefficient, calculating fields in
- 5 said layer, accounting for the incident material refractive index and absorption
- 6 coefficient, performed using thin film optics or by solving Maxwell equations.
- 1 22. The method of claim 16, including laying out a layout pattern on a mask including
- 2 the layout object to be imaged on said layer, said laying out including applying proximity
- 3 correction using a lithography model comprising, for an incident material different than
- 4 air characterized by its refractive index and absorption coefficient, calculating fields in
- 5 said layer, accounting for the incident material refractive index and absorption
- 6 coefficient, performed using thin film optics or by solving Maxwell equations, and
- 7 accounting for a gap between the incident material and the resist using thin film modeling
- 8 or by solving Maxwell equations.
- 1 23. The method of claim 16, including laying out a layout pattern on a mask including
- 2 the layout object to be imaged on said layer, the layout pattern comprising an alternating
- 3 aperture phase-shifting mask layout, said laying out including applying proximity
- 4 correction using a lithography model comprising, for an incident material different than
- 5 air characterized by its refractive index and absorption coefficient, calculating fields in
- 6 said layer, accounting for the incident material refractive index and absorption
- 7 coefficient, performed using thin film optics or by solving Maxwell equations.
- 1 24. The method of claim 16, including laying out a layout pattern on a mask including
- 2 the layout object to be imaged on said layer, wherein said imaging the object on said
- 3 layer through said projection lens, includes applying an off-axis setting for the projection
- 4 lens, the off-axis setting obtained using a lithography model comprising, for an incident
- 5 material different than air characterized by its refractive index and absorption coefficient,
- 6 calculating fields in the resist, accounting for the incident material refractive index and
- 7 absorption coefficient, performed using thin film optics or by solving Maxwell equations.

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- 1 25. The method of claim 16, including laying out a layout pattern on a mask including
- the layout object to be imaged on said layer, the layout pattern comprising an assist
- 3 feature having a size and a distance from a corresponding main feature, said laying out
- 4 including determining said size and distance using a lithography model comprising, for
- 5 an incident material different than air characterized by its refractive index and absorption
- 6 coefficient, calculating fields in said layer, accounting for the incident material refractive
- 7 index and absorption coefficient, performed using thin film optics or by solving Maxwell
- 8 equations.
- 1 26. The method of claim 16, including laying out a layout pattern on a mask including
- 2 the layout object to be imaged on said layer, the layout pattern comprising an attenuated
- 3 phase-shifting mask having sizing parameters, said laying out including determining said
- 4 sizing parameters using a lithography model comprising, for an incident material
- 5 different than air characterized by its refractive index and absorption coefficient,
- 6 calculating fields in said layer, accounting for the incident material refractive index and
- 7 absorption coefficient, performed using thin film optics or by solving Maxwell equations.
- 1 27. The method of claim 16, wherein the sample comprises a wafer including a plurality
- 2 of materials forming a wafer stack, and including laying out a layout pattern on a mask
- 3 including the layout object to be imaged on said layer, said laying out including applying
- 4 proximity correction using a lithography model comprising, for an incident material
- 5 different than air characterized by its refractive index and absorption coefficient, dividing
- 6 the refractive indices and absorption coefficients of all the materials in the wafer stack by
- 7 the refractive index of the incident material.